Lec : 12 Expert Systems.

→ Expert System

Computer Software that :

- emulates human expert
- Use human Knowledge to solve problems that normally would require human intelligence.
- Deals with small, well defined domains of expertise
- Is able to solve real-world Problems.
- Is able to act as a cost-effective consultant
- Can explains reasoning behind any solutions it finds
- Should be able to learn from experience.

→ An Expert System is a system that employs human knowledge Captured in a computer to solve problems that ordinarily require human expertise

→ Expert Systems manipulate Knowledge while conventional programs manipulate data.

→ An expert System is often defined by its structure.

→ Knowledge Based System & Expert System

* Knowledge Based System : Computer Software that depends on Lage database gives output of an input according to stored data → There is no conclusion

* Expert Systems Development (ES lifecycle)

مراحل عمل أنظمة خبيرة

1. Problem Definition
   → explain the problem and collect all data about it (analysis)
2. System Design
   (Knowledge acquisitions)
3. Formalization
   (Logical design, .., tree structures)
4. System Implementation
   (building a prototype)
5. System Validation.
   (test your system)

* Characteristics of an Expert System.

- Expertise
- Depth
- Symbolic Reasoning
- Self Knowledge.

→ How Conclusions are made ?

[1] Goal Driven Reasoning (backword chaining)
an inference technique which uses IF THEN rules to repetitively break a goal into smaller subgoals (to reach initial data) which are easier to prove.

[2] Data Driven Reasoning (Forward Chaining)
an inference technique which uses IF THEN rules to deduce a problem solution from initial data (to goal)
Note : Here the System must initially populated with data

→ Expert System Ability

[1] Uncertainly : The ability of the system to reason with rules and data which are not precisely known.

→ System can give us information about degree of uncertainty in the knowledge or data stored in system

[2] Explanations : The ability of the system to explain the reasoning process that it used to reach a recommendation

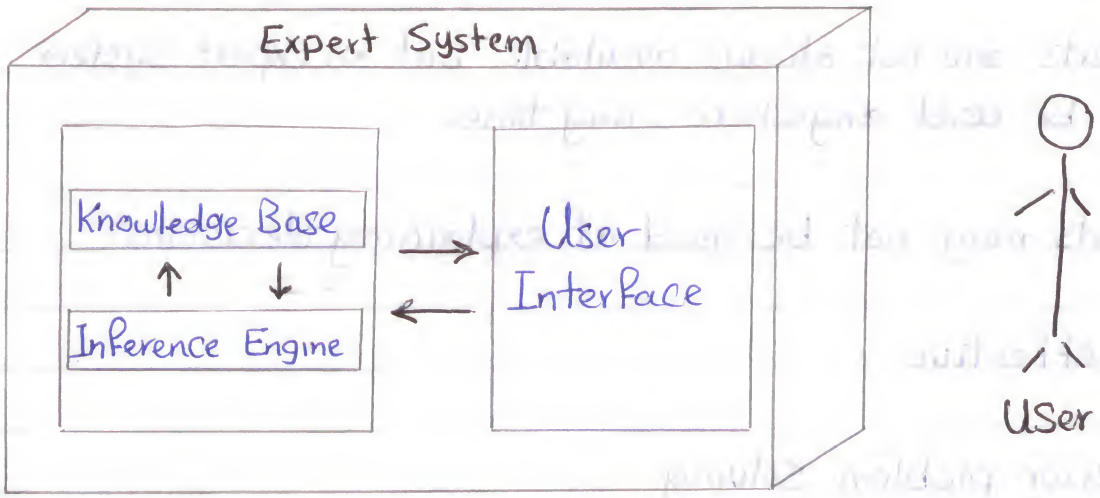
→ System can give us explanation of conclusions

→ System knows which rules were used during the inference process.

[3] User Interface : That portion of the code which creates an easy way to use the system.

[4] Data Representation : The way in which the problem specific data in the system is stored and accesed.

* Expert System Components.



[1] The Knowledge Base:
Is the collection of facts and rules which describe all the knowledge about the problem domain.
(we get it from experts)

[2] The Inference Engine:
is the part of the system that chooses which facts and rules to apply when trying to solve the user's query

[3] The User Interface:
is the part of the system which takes in the user's query in a readable from and passes it to the inference engine. It then displays the results to the user.

* Advantages

- Experts are not always available but an expert system can be used anywhere, any time.
- Experts may not be good at explaining decisions
- Cost effective
- Superior problem solving
- Reliability: Human experts are not 100 % reliable or consistent
- Work with incomplete information
- Transfer of Knowledge.

* Disadvantages

- High development costs
- Can not learn from experience.
- Not all problems are suitable.
- limited domain
- Systems are not always up to date, and don't learn
- No "Common Sense"
- Experts needed to setup and maintain System

* Creating an Expert System

Two Steps

1- Knowledge acquistion: Extracting Knowledge and methods from the experts.

2. Knowledge representation: Reforming Knowledge / methods into an organised form.

* What is Knowledge ?

- Data : Raw Facts , Figures , measurements
- Information : Refinement and use of data to answer specific questions.
- Knowledge : Refined information.

* Sources of Knowledge

1. Documented
   - .books , journals , procedures
   - . Films , databases
2. Undocumented
   - . people's Knowledge and expertise
   - . people's minds, other senses

* Type of Knowledge

- Facts ex: dogs , teeth , carnivore
- Relations ex: mother of Paul
- Rules ex: IF breathing >20 then hyperventilating
- Concepts ex: For All X & Y
- Procedures ex: Do this then that

Show the lecture 12 from Slide 31 to 46